भारतीय मानक
Indian Standard

IS 5975 : 2020

कच्ची चीनी — विशिष्टि

(दूसरा पुनरीक्षण)

Raw Sugar — Specification

(*Second Revision* **)**

ICS 67.180.10

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

November 2020 **Price Group 4**

Sugar Industry Sectional Committee, FAD 02

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Sugar Industry Sectional Committee had been approved by the Food and Agriculture Division Council.

Raw sugar is manufactured in India mainly for exports, which have been rising steadily during the past few years. It is therefore, imperative to assess and control the quality of raw sugar. This standard was published in 1970. The adoption of this standard in India would help in defining the quality of raw sugar in a manner that would enable better quality control. Besides, it will help in achieving uniformity in the methods of analysis of raw sugar thereby facilitating the comparison and interpretation of results.

The first revision of this standard is being undertaken to align with the revised Codex Standard for Sugars, CODEX STAN 212-1999; and to align the methods of test with the International Commission for Uniform Methods of Sugar Analysis (ICUMSA).

In this revision of standard, the raw sugar categorized as low pol (LP), very high pol (VHP) and very very high pol (VVHP). Besides these, requirements for dextran and starch are added to the raw sugar. Limit of Sulphur dioxide reduced.

In the formulation of this standard, due consideration has been given to the provisions of the *Food Safety and Standards Act*, 2006 and the Rules framed thereunder and the Legal Metrology (Packaged Commodities) Rules, 2011. However, this standard is subject to the restrictions imposed under these, wherever applicable.

The composition of the Committee responsible for the formulation of this standard is given at Annex E.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

RAW SUGAR — SPECIFICATION

(Second Revision)

1 SCOPE

This standard prescribes the requirements and the methods of sampling and analysis for raw sugar.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards given below:

IS No.	*Title*
460 (Part 1) : 1985	Specification for test sieves: Part 1 Wire cloth test sieves (*third revision*)
1151 : 2003	Refined sugar — Specification (*second revision*)
1943 : 1995	Textiles — A twill jute bags — Specification (*second revision*)
10146 : 1982	Specification for polyethylene for its safe use in contact with foodstuffs, pharmaceuticals and drinking water
10910 : 1984	Specification for polypropylene and its copolymers for its safe use in contact with foodstuffs, pharmaceuticals and drinking water
14350 : 1996	Code for hygienic conditions in sugar factories
15279 : 2003	Sugar and sugar products — Methods of test

3 TERMINOLOGY

For the purpose of this standard, the following' definition shall apply.

3.1 Raw Sugar — Unwashed, centrifugal sugar with a minimum polarization of 96.5 °Z; surrounded by the original film of molasses; derived from sugar cane or sugar beet; to be further refined or reprocessed for making it superior quality sugar.

4 REQUIREMENTS

4.1 Description — Raw sugar shall be in the form of uniform crystals of 500 to 800 micron size. It shall be free from dirt and extraneous matter and from fermented, musty or other undesirable odour.

4.2 The product shall also comply with the requirements given in Table 1. Depending upon the quality parameters, it shall be categorized as Low Pol (LP), Very High Pol (VHP) and Very Very High Pol (VVHP).

4.3 Raw sugar shall be manufactured, packed, stored and distributed under hygienic conditions (*see* IS 14350).

Table 1 Requirements for Raw Sugar

(*Clause* 4.2)

Sl No.	**Characteristics**	**Requirements**			**Method of Test, Ref to**	
					Annex of this Standard	**Cl No. of IS 15279**
(1)	(2)		(3)		(4)	(5)
		LP	VHP	VVHP		
i)	Polarization,°Z, *Min*	96.5	98.0	99.0	—	6
ii)	Reducing sugars, percent by mass, *Max*	1.0	0.8	0.6	—	7
iii)	Sulphated ash, percent by mass, *Max*	0.8	0.6	0.5	—	10
iv)	Safety factor, *Min*	0.3	0.3	0.3	A	—
v)	Crystal size MA, *Min*	0.80	0.80	0.80	B	—
	CV *Max*	40	40	40		
vi)	Colour (IU) *Max*	3000	1500	650		8
vii)	Starch mg/kg, *Max*	200	150	100	C	
viii)	Dextran mg/kg, *Max*	150	125	75	D	
ix	Sulphur dioxide, mg/kg, *Max*	10	10	10		13

5 PACKING

Raw sugar shall be packed in clean, sound and new jute bags (*see* IS 1943) or bags made of polypropylene (*see* IS 10910) or bags made of high density-polyethylene (*see* IS 10146). The jute bags may be lined with polyethylene film. The mouth of each bag shall be either machine-stitched or rolled over and hand-stitched. If hand-stitched, the stitches shall begin two rows with at least 14 stitches in each row. Raw sugar may also be packed in one-ton jumbo bags suitable to transport through sea rout.

6 MARKING

6.1 Each bag/pack shall bear legibly and indelibly the following particulars:

a) Name of the product;
b) Name and address of the manufacturer;
c) Net quantity of sugar in the bag;
d) Month and year of manufacture;
e) Batch or code number;
f) The words 'Best before t (month and year to be indicated); and
g) Any other information required under the *Legal Metrology (Packaged Commodities) Rules*, 2011 and the *Food Safety and Standards (Packaging and Labelling) Regulations*, 2011

6.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

7 SAMPLING

Representative samples of raw sugar shall be drawn and the criteria for conformity to this standard shall be established, according to the method prescribed in Annex A of IS 1151.

ANNEX A

[*Table* 1, *Sl. No.* (iv)]

CALCULATION OF SAFETY FACTOR

A-1 CALCULATION

Calculate the safety factor of raw sugar by the following formula:

$$\frac{\text{Moisture content}}{100 - \text{polarization } {}^{o}Z}$$

ANNEX B

[*Table* 1, *Sl. No.* (v)]

DETERMINATION OF CRYSTAL SIZE

B-1 APPARATUS

B-1.1 Hot-Air-Oven

B-1.2 Standard Sieves — 500-micro IS sieve or equivalent.

NOTE — In case IS sieves [*see* IS 460 (Part 1)] are not available, BS sieve 30, ASA sieve 35, and Tyler sieve 32, which have their apertures within the limits specified for 500 micro IS sieve may be used.

B-2 PROCEDURE

Take 100 g of raw sugar, wash with 100 ml of anhydrous alcohol and dry. Remove the excess of alcohol by filtration. Dry the washed sugar in an air oven at 800 C for 1 h. Cool and silt the sugar in IS or equivalent sieves in an automatic shaker for 5 min. Find the weight retained on each standard sieve and directly calculate the percentage of sugar corresponding to different grain sizes.

ANNEX C

[*Clause* 4.2 *Table* 1 *Sl. No.* (vii)]

DETERMINATION OF STARCH IN RAW SUGAR

C-1 PROCEDURE

Dissolve 10 g raw sugar in 10 ml. of distilled water in a 50 ml. centrifuge tube. Add 24 ml of alcohol (70 percent V/V) and a few drops of saturated potassium chloride and after shaking vigorously keep the mixture overnight. Then centrifuge it at 2 500 RPM for 15 min. Decant the clear supernatant liquid and extract the residue with 5 ml of 50 per cent formamide solution for 50 min in a boiling water bath. Near the end of the extraction wash the sides of the tube with distilled water to wash down any adherent material. Make up the solution to 25 ml. mark in the centrifuge tube with distilled water and centrifuge again. Transfer the clear supernatant liquid in a volumetric flask of 25 ml. capacity. Add one ml. of M/200 iodine solution, 20 ml. of concentrated HCL and make up the contents of the flask to the mark by distilled water. Measure the blue colour developed at 680 nm in a photo electric colorimeter using 2 cm cell against blank. From the optical density readings, the results are interpolated from the standard curve to be obtained as described below.

C-2 PROCEDURE FOR DRAWING STANDARD CURVE FOR THE ESTIMATION OF STARCH

Weigh 0.25 g of corn starch accurately and make into a thin paste with 2 ml of distilled water in a small beaker. Then heat and mix with distilled water (50 ml). Boil the mixture gently for 10 min and cool, transfer to a 100 ml volumetric flask and make upto the mark with distilled water. Take 10 g of sucrose (A.R. Quality) in 10 centrifuge tubes of 50 ml. capacity. The first tube serves as blank and to the rest 9 tubes add 0.2, 0.4, 0.8, 1.2, 1.6, 2.0, 2.4, 2.8 and 3.2 ml of starch solution respectively. Add in the first tube which serves as a blank. 10 ml. of distilled water and to the rest 9 tubes, 9.8 9.6, 9.2, 8.8, 8.4, 8.0 7.6, 7.2 and 6.8 ml. of distilled water respectively. The starch content of the

samples is then estimated by the procedure described above by measuring the intensity of blue color at 680 mm in 2 cm cell. The optical density values are then plotted against the concentration of starch to obtain the standard curve.

ANNEX D

[*Clause* 4.2 *Table Sl. No.* (vii)]

DETERMINATION OF DEXTRAN IN RAW SUGAR

D-1 FIELDS OF APPLICATION

High dextran cane raw sugar causes severe processing problems in mills and refineries.

D-2 PRINCIPLE

This method measures the haze formed by dextran-like polysaccharides when alcohol is added to a solution of raw sugar. White sugar and plantation white sugar.

The rest sample is dissolved in water. Soluble starch is destroyed by incubation with a suitable enzyme. Protein is removed by precipitation with trichloroacetic acid followed by filtration with acid-washed kieselguhr.

The dextran haze is produced by diluting an aliquot of the treated, filtered solution, to twice the aliquot volume.

D-3 REAGENT

During the analysis unless otherwise stated, use reagents only of analysis grade and only de-ionised or distilled water.

D-3.1 Standard Dextran — T110 or T500. Determine its moisture content in duplicate, to two decimal places, by drying approximately 2 g of the solid in an oven at 105 °C for 3 h, record the weights to 0.1 mg. individual determinations must be within 1 percent of the mean of the moisture content.

D-3.2 Standard Dextran Solution — 0.8 mg/mL. Quickly weigh a quantity of the up-dried dextran that contains 0.16 g of anhydrous dextran, that is, weigh out.

$$0.16.\ 100/100\text{-}w_w - g$$

Of undried dextran in to a 100 ml beaker, where w_w is the water content of dextran. Record the actual mass to 0.1 mg.

Dissolve the dextran by adding 1 mL to 2 mL of water to form a slurry. Allow the particles to become uniformly hydrated by standing for about 10 min with occasional stirring. Add more water in small aliquots while a gel mass remains. When about 25 mL has been added and no get is present, wash the slurry in to a 200 mL volumetric flask with water to a volume of about 80 mL.place the flask in boiling water bath for 30 min. Cool to room temperature in a cold water bath then make up to the mark with water. Prepare standard dextran solution daily. To not store overnight.

D-3.3 Standard Dextran Solution — 0.08 mg/mL. Pipette 10 mL of standard dextran solution into a 100 mL volumetric flack. dilute to the mark to the mark and mix well.

D-3.4 Trichloroacetic Acid Solution — 100 g/l. Dissolve 20.2 g ± 0.1 g of trichloroacetic acid (TCA) in distilled water and dilute to 200 mL. This reagent will keep for two weeks, stored under refrigeration in a dark brown bottle.

D-3.5 Denatured absolute alcohol (DAA) — Containing ethanol with 2.0 percent ± 0.2 percent m/m of methanol, and with a water content of less than 0.5 percent m/m. If particulate matter is visible, filter through filter paper. Store in an air – tight container.

D-3.6 Standard Sucrose — Use only pure refined sugar with a starch concentration of less than 2 mg/kg (available as beet extra white sugar). Cheek the haze which develops when 8.2 mL of sucrose/TCA solution plus 4.5 mL distilled water 25 mL with denatured alcohol according to the procedure. The absorbance should not exceed 0.003 in a 1 cm cell at 720 nm when read against a blank of 8.0 mL of sucrose-TCA solution diluted to 25 mL with distilled water.

D-3.7 Sucrose-TCA Solution — Dissolve 250 g ± 0.1 g of standard sucrose in distilled water in a 500 mL volumetric flask. Add 78 mL of TCA solution, make up to the mark and mix. This solution should be made up freshly as required.

D-3.8 Starch-removing Enzyme — A heat stable α-amylase is suitable.

NOTE — For other enzymes cheek that dextran is not attached by digesting a standard dextran solution with one drop of the enzyme at 55 °C ± 5 °C for 15 min: add TCA. Filter and measure dextran haze as for standards. The absorbance should be within 5 percent of the reading obtained for the same dextran standard without enzyme treatment.

D-3.9 Acid-washed kieselguhr — Add 50 g ± 5 g of kieselguhr to 1 L distilled water: add 50 mL ± 5 mL of concentrated hydrochloric acid to the mixture and

stir for 5 min. Filter the kieselguhr on a large Buchner funnel and wash with distilled water until free from acid, testing the washings with litmus or equivalent test paper. Dry the washed kieselguhr for 6 h at 96 °C to 100 °C and store in a closed container.

D-4 APPARATUS

D-4.1 Spectrophotometer — Suitable for the measurement of absorbance at 720 nm with matched cells. The cell length selected may be 2 cm or 5 cm as available The spectrophotometer should comply with the following specifications:

a) spectral band-pass 10 nm or less;

b) wavelength reproducibility ± 0.5 nm; and

c) absorbance reproducibility ± 0.003 at 1.0 absorbance.

D-4.2 Water Baths — A boiling water baht, one capable of operating at 50 °C to 60 °C, and another containing cold tap water for cooling.

D-4.3 Flask Shaker

D-4.4 Analytical Balance — Readable to 0.1 mg.

D-4.5 Stopwatch

D-4.6 Volumetric Flasks — 25 mL (ISO class A), 100 mL, 200 mL and 500 mL.

D-4.7 Bulb Pipettes — 1 mL, 2 mL, 3 mL, 4 mL, and 10 mL.

D-4.8 Graduated Pipettes — 1 mL, 5 mL, and 10 mL.

D-4.9 Funnel — To fit in to 100 mL volumetric flask.

D-4.10 Automatic Pipettes or Safety Pipette — 10 mL.

D-4.11 Buchner Funnel and Flask — 5.5 cm funnel diameter and 250 mL flask volume, respectively.

D-4.12 Burettes — 25 mL and 50 mL capacity.

D-4.13 Conical Flask — 200 mL.

D-4.14 Beaker — 150 mL.

D-4.15 Filter Paper — 5.5 cm (Whatman No. 5 or equivalent).

D-5 PROCEDURE

D-5.1 Preparation of Standards and Calibration Graph for Raw Sugar

In thirteen 25 mL volumetric flasks prepare the standard solutions as described below.

As alcohol must be added within 20 min of addition of dextran solution to sucrose-TCA, and as absorbance must be read exactly 20 min after mixing with alcohol it is recommended that only 4 or 6 standards and the blank be prepared at a time.

a) Using 10 ml graduated pipette, add 8 ml of the sucrose–TCA solution to each of the 13 flasks. Do not pipette by mouth – use a safety bulb.

b) Using 1 mL and 5 mL graduated pipettes or a series of bulb pipettes. Add respectively to the first twelve flasks, aliquots of standard dextran solution in accordance with Table 1.

c) Using a 5 mL graduated pipette add respectively to the 12 flasks aliquots of distilled water according to Table 1, to make a total volume of 12.5 mL

d) Make flask number 13 up to the mark using distilled water and mix by shaking. This is the blank solution.

e) Add DAA (5.5) slowly from a 50 mL burette to the 25 mL mark of the flask while gently swirling the flask. The time of the alcohol should be between 30 and 60 s. Mix the contents of the flask by inverting gently there times. Start the stopwatch immediately after the mixing step is complete.

NOTES

1 Alcohol must be added within 20 min of addition of dextran solution to the sucrose – TCA solution.

2 Avoid vigorous shaking of the flask as it may cause coagulation of the dextran haze.

3 As the absorbance must be read at a precise time after the mixing step it is recommended that alcohol be added to the dextran standards at uniform time intervals (3 min or 4 min).

a) Read and record the cell corrections at 720 nm of a pair of matched cells using distilled water.

b) Approximately 17 to 18 min after the completion of the mixing step, rinse a cell with the blank solution and then and then fill the cell. In a similar way, rinse and fill the other cell with one of the standard solutions. Clean the optical face of the cells with a tissue, cheek that striations are absent.

c) At 20 min ± 10 s after completion of the mixing step, read and record the absorbance of the test solution to 0.001 against that of the blank solution at 720 nm.

d) Repeat the above two steps for each dextran standard. It is not necessary to refill the blank solution cell for each determination.

e) Repeat the dextran standardization procedure using another set of freshly prepared standard solution.

f) Calculate the actual concentration of dextran in each flask (Table 1) using the moisture in the dextran and the actual weight taken, for example,

Moisture in dextran, in percent	12.16
Mass of un-dried dextran equal to 0.16 g dry, in g	0.1821
Actual mass of dextran, in g	0.1904
Concentration in flask 10, in mg/kg	600* 0.1904/0.1821 = 627

Apply the cell correction to the absorbance of each standard solution. Plot actual dextran concentration in mg/kg against corrected absorbance for each standard and draw the curve of best fit. The calibration graph should be a gradual curve at low dextran concentration and become almost linear at high dextran concentration. Individual points should lie within 5 percent of the absorbance value of the curve of best fit at low concentration and within 3 percent at high concentration.

D-5.2 Dextran Determination in Raw Sugar

a) Weigh out 32.0 g ± 0.1 of raw sugar, transfer to a 200 mL conical flask. Add 50 ml of distilled water. Stopper and dissolve.

b) Add 0.1 mL of the starch enzyme. Mix the contents well and stopper the flask. Place the flask in a water bath at 55 °C ± 5 °C for 15 min ± 2 min. Cool the flask to room temperature in a cold water bath.

c) Pour the mixture through a funnel into a 100 mL volumetric flask. With distilled water, rinse the flask thoroughly, through the funnel into the volumetric flask.

d) Add 10.0 mL ± 0.1 mL of TCA solution, make up to the mark, stopper and mix well.

e) Pour the solution to a 150 ml beaker. Add two heaped teaspoons

f) (about 6 to 8 g) of acid-washed kieselguhr and mix well. Filter the mixture through a 5.5 cm Buchner funnel under vacuum, using the first 10 mL to 15 mL of filtrate to rinse the funnel and flask.

g) Using a 25 mL graduated burette, add 12.5 mL volumetric flasks.

h) Add DAA slowly from a 50 mL burette to the 25 mL mark of one flask, gently swirling the flask. The time for the alcohol addiction should be between 30 and 60 s. Mix the contents of the flask by inverting gently there times. Start the stopwatch immediately the mixing step is complete.

NOTES

1 Add alcohol within 20 min of addition of the TCA solution.

2 Avoid vigorous shaking of the flask as it may cause coagulation of the dextran haze.

a) To the other flask add distilled water to the 25 ml mark and mix. This is the test blank.

b) Determine the cell correction at 720 nm against distilled water using a pair of matched cells the same size as used to establish the standard graph.

c) Approximately 17 min to 18 min after the completion of the mixing step rinse the reference cell. In a similar way, rinse and fill the then fill with the rest solution. Clean the optical faces of the cells with a tissue, check that striations are absent.

d) At 20 min ± 10 s after the completion of the mixing step read and record to 0.001 the absorbance of the test solution against that of the blank solution at 720 nm. Immediately after reading, visually inspect the contents of the test solution cell to check for flocculation. If the haze has flocculated, repeat the analysis.

e) If the dextran haze absorbance is higher than the upper limit of the calibration graph, repeat the determination by diluting the sample with standard sugar, for example, 16.0 g ± 0.1 g of sample with 16.0 g ± 0.1 g of standard sugar.

D-6 EXPRESSION OF RESULTS

D-6.1 Calculations

D-6.1.1 *Calculation (Raw Sugar)*

Apply the cell correction to the absorbance of raw sugar. Obtain the dextran concentration in the raw sugar directly from the standard curve obtained from Table 1 by reading against the corresponding solution absorbance. If the sample was mixed with standard sugar, multiply the result by the dilution factor. Express results to the nearest mg/kg sugar.

Table 2 Standard Dextran Solution for Raw Sugar

[(*Clauses* 5.1 b) *and* D-6.1.1]

Flask No.	Sucrose/TCA Solution mL	0.08 mg/mL Standard Dextran Solution mL	0.8 mg/mL Standard Dextran Solution mL	Distilled Water mL	Dextran Concentration Mg/kg Sugar
1	8.0	0.0	–	4.5	0
2	8.0	1.0	–	3.5	20
3	8.0	2.0	–	2.5	40
4	8.0	3.0	–	1.5	60
5	8.0	4.0	–	0.5	80
6	8.0	–	1.0	3.5	200
7	8.0	–	1.0	3.0	300
8	8.0	–	2.0	2.5	400
9	8.0	–	2.0	2.0	500
10	8.0	–	3.0	1.5	600
11	8.0	–	3.0	1.0	700
12	8.0	–	4.0	0.5	800
13	8.0	–	–	17.0	Blank

ANNEX E

(*Foreword*)

COMMITTEE COMPOSITION

Sugar Industry Sectional Committee, FAD 02

Organization	*Representative(s)*
National Sugar Institute, Kanpur	Shri Narendra Mohan (***Chairman***) Shri Ashutosh Bajpai (*Alternative*)
Army Service Core (ASC), New Delhi	Lt Col B. B. Sahu
CONCERT, Chennai	Shri R. Santhanam Shri M. Somasundaram (*Alternative*)
Consumer Guidance Society of India, Mumbai	Shri Sitaram Dixit Dr M. S. Kamat (*Alternative*)
Food Corporation of India, New Delhi	Shri Deepak Kumar Panwar Shri Rakesh Kumar Ranjan (*Alternative*)
Food Safety Standards Authority of India, New Delhi	Ms Apoorva Srivastava (Technical Officer)
Global Cane Sugar Ltd, New Delhi	Dr G. S. C. Rao Mr Anil Srivastava (*Alternative*)
Indian Institute of Sugarcane Research, Lucknow	Dr A. D. Pathak Dr A. K. Sharma (*Alternative*)
Indian Institute of Toxicology Research, Lucknow	Dr Yogeshwer Shukla
Indian Sugar Mills Association, New Delhi	Shri G. K. Thakur Shri Deep Malik (*Alternative*)
Indian Sugar Exim Corporation, New Delhi	Mr Rajiv Aggarwal Mr Rajeev Kurup (*Alternative*)
MAARC Labs, Pune	Dr Vasudha Keskar
MANAS Industry, Maharashtra	Shri Jeevan Vasant Jadhav
Ministry of Consumer Affairs, Food & Public Distribution, New Delhi	Shri Suresh Chandra
National Co-operative Development Corporation, New Delhi	Shri K. P. Vaish Shri N. K. Sharda (*Alternative*)
National Fed of Co-operative Development Corporation, New Delhi	Mr Manohar Gopal Joshi
The Sugar Technologists Association of India, New Delhi	Shri Sanjay Awasthi Shri Anurag Goyal (*Alternative*)
Triveni Engineering & Industries Ltd, Muzaffarnagar, UP	Shri Rajesh Singh Shri P. K. Khadelwal (*Alternative*)
Tamil Nadu Sugar Corp Ltd (TASCO), Chennai	Shri E Muthuvelappan
VSI Pune	Dr Rajeev Dani (*Alternative*)
Walchandnagar Industries	Shri D. R. Sardeshmukh Shri P. V. Kawade (*Alternative*)
In personal Capacity	Prof S. K. Gupta
BIS Directorate General	Shri P. Rajesh, Scientist 'E' and Head (FAD) [Representing Director General (*Ex-officio*)]

Member Secretary

Shri Rajpal
Scientist 'C' (FAD), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc No.: FAD 02 (15110).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002	2323 7617, 2323 3841
Eastern	: 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi, KOLKATA 700054	2337 8499, 2337 8561, 2337 8626, 2337 9120
Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg, CHANDIGARH 160019	265 0206, 265 0290
Southern	: C.I.T. Campus, IV Cross Road, CHENNAI 600113	2254 1216, 2254 1442, 2254 2519, 2254 2315
Western	: Manakalaya, E9 MIDC, Marol, Andheri (East), MUMBAI 400093	2832 9295, 2832 7858, 2832 7891, 2832 7892

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. COIMBATORE. DEHRADUN. DURGAPUR. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. JAMMU. JAMSHEDPUR. KOCHI. LUCKNOW. NAGPUR. PARWANOO. PATNA. PUNE. RAIPUR. RAJKOT. VISAKHAPATNAM.

Published by BIS, New Delhi